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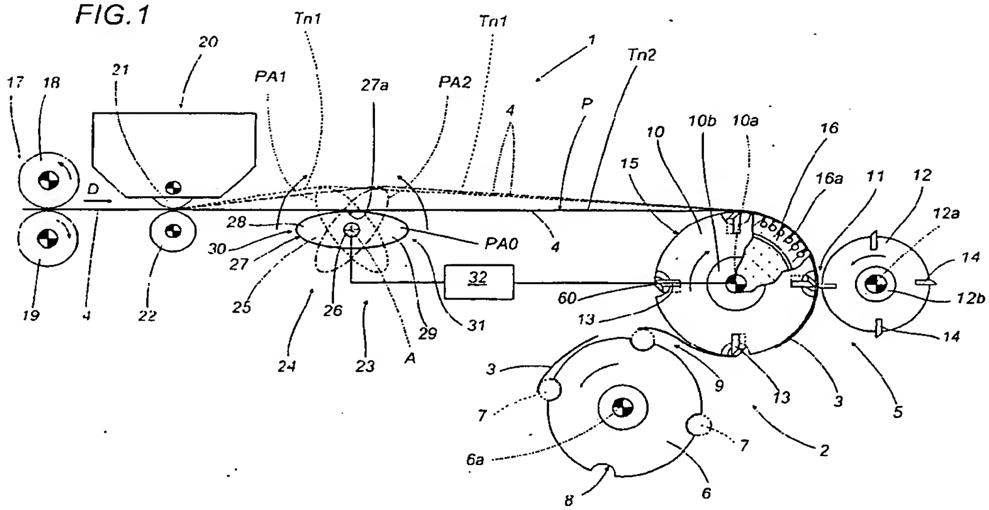
(54) A unit for generating discrete lengths of paper material from a continuous strip

(57) Tipping papers (3) used to join filter plugs and cigarette sticks (7) are obtained from a continuous strip (4) caused to advance by pinch rolls (17) along a feed path (P) in a given direction (D), and conveyed at a first tension (Tnl) through a cutting station (5) at which the individual papers (3) are separated by cuts made at a predetermined frequency and synchronously with the operation of a diverter element (24) located between the pinch rolls (17) and the cutting station (5). The diverter element serves to bring about a cyclical variation in the first tension of the strip (4) and is embodied as a cam (25) with a profile (27) having two distinct lobes (28, 29), made to oscillate between two limit positions (PA1, PA2) in which the lobes (28, 29) interact alternately with the strip, diverting it and causing it to assume the first tension (Tn1), and passing through an intermediate position (PAO) in which the strip is allowed to assume a second tension (Tn2) slacker than the first; the cam (25) completes each full cycle between the two limit positions (PA1, PA2) at a frequency equivalent to half the frequency with which the papers are cut.

FIG. 1



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Description

[0001] The present invention relates to a unit serving to generate discrete lengths of paper material from a continuous strip.

[0002] The invention finds application to advantage in a cigarette manufacturing machine, and in particular the filter tip attachment of a cigarette maker, for the preparation of tipping papers from a decoiling roll of continuous strip material; indeed reference is made explicitly to such an application in the following specification albeit with no limitation in scope applied.

[0003] Filter tipped cigarettes are fashioned generally by interposing a double length filter plug between two axially aligned sticks of cigarette rod, whereupon the three elements are joined by a band of gummed paper and the resulting assembly is cut in half to produce two single filter cigarettes.

[0004] Conventionally, the tipping papers are obtained from a continuous strip of gummed material directed along a predetermined path toward a cutter device by which the strip is divided into discrete bands of prescribed length.

[0005] The cutter device comprises two contrarotating rollers with mutually parallel axes of rotation, disposed tangentially one to another. One roller affords an aspirating surface against which the strip is held by suction and drawn forward, and both are equipped with relative blades equispaced angularly around the surface of revolution.

[0006] Typically, the blades of one roller will interact with corresponding blades of the other roller in such a way as to sever the strip along transverse lines, effecting a scissor type cut: accordingly, each blade of the one roller combines with a blade of the other roller to constitute scissor means by which a discrete length is cut progressively from the strip as the rollers rotate.

[0007] One of the rollers, and more exactly the suction roller, continues to retain each successive tipping paper on its peripheral face after the relative cut is completed and carries it thus into contact with a double cigarette assembly as described briefly above, made up of two cigarette sticks and a double filter plug.

[0008] For the jointing operation to be successful, the tipping papers must be spaced apart at a suitable distance one from the next after being severed from the continuous strip; this is done by causing the suction roller to rotate at a peripheral velocity higher than the linear velocity at which the strip advances.

[0009] It follows therefore that in executing the single scissor cuts mentioned above to produce discrete bands, which are not separated immediately but will be distanced only after a given interval of time, the difference between the peripheral velocity of the suction roller and the linear feed rate of the strip does not allow a correct separation of the discrete papers from the strip. Because of the traction force generated by the suction roller, in effect, the strip is subject to a pulling action which during the course of each successive cutting operation becomes unsustainable for the portion of material growing narrower by degrees at the end of the cutting stroke, and induces excessive tensions in the as yet uncut edges of the material, with the result that the tipping paper tends to separate by tearing before the actual cutting action can be fully completed. The tipping papers separated in this manner are therefore unusable by reason of the irregularities discernible at the extremity of the cutting line.

[0010] To the end of overcoming such drawbacks, US Patent 4,943,341 teaches the expedient of introducing a diverter element with a cyclical action preceding the cutter device in the direction followed by the strip, such as will vary the tension of the strip at a frequency coinciding with that of the cutting stroke.

[0011] With strip feed rates becoming faster and faster, and the demand for increasingly higher production tempos, the diverter elements currently in use are now no longer able to match the cutting frequency of the relative machines.

[0012] The object of the invention is to provide a unit for generating discrete lengths of paper material from a continuous strip, such as will remain free of the drawback described above.

[0013] The stated object is realized in a unit according to the present invention for generating discrete lengths of paper material from a continuous strip, comprising cutting means by which the papers are severed singly and in succession from the strip at a predetermined cutting frequency, also feed means by which the strip is caused to advance along a predetermined path and in a predetermined direction at a first predetermined tension, and tensioning means interposed between the feed means and the cutting means of which the function is to vary the first predetermined tension of the strip cyclically and synchronously with the selfsame cutting means, characterized in that the tensioning means comprise a diverter element presenting at least a first and a second transmission member and designed to oscillate cyclically when in operation between two tensioning limit positions in which the at least first and second transmission members interact alternately with the strip in such a way that the strip is diverted and caused to assume the first tension, passing also through an intermediate position in which the strip is caused to assume a second tension slacker than the first tension, and completing each full oscillating cycle between the two limit positions at a frequency equivalent at least to half the cutting frequency of the cutting means.

[0014] The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

- fig 1 shows a portion of a cigarette manufacturing machine, illustrated schematically in a front view and equipped with a unit embodied according to the present invention for generating discrete lengths of

paper material from a continuous strip;

- fig 2 illustrates a second embodiment of a unit for generating discrete lengths of paper material as in fig 1;
- fig 3 illustrates a further embodiment of a unit for generating discrete lengths of paper material as in fig 1;
- fig 4 illustrates a detail of fig 1, shown in a second embodiment;
- figs 5 to 9 illustrate the successive stages of an operating cycle pertinent to a further embodiment of the unit according to the present invention for generating discrete lengths of paper material from a continuous strip.

[0015] Referring to figs 1...4 of the drawings, 1 denotes a portion, in its entirety, of a cigarette making machine (not illustrated), and in particular the filter tip attachment of a cigarette maker, which includes a unit 2 for generating discrete lengths 3 of wrapping material, referred to simply as tipping papers, from a continuous strip 4 caused to decoil from a roll (not illustrated) and advance along a predetermined feed path P in a given direction D at a given tension and a given velocity.

[0016] As discernible from fig 1, the unit 2 comprises a cutter device 5 by which the papers 3 are severed from the continuous strip 4 and released onto a conveying roller 6 of familiar embodiment set in rotation anticlockwise about a respective axis 6a. The roller 6 is designed to convey assemblies 7 consisting each in two cigarette sticks separated one from the other by a double length filter plug, which are retained pneumatically in conventional manner by respective flutes 8 extending parallel to the straight line generators of the roller, and advanced by the roller 6 in a direction transverse to their own axes through a transfer station 9 at which a paper 3 is offered by the cutter device 5 to the external surface of each assembly 7.

[0017] In the example illustrated, the cutter device 5 comprises a first suction roller 10 and a second roller 12, disposed substantially tangential one to the other and rotatable about respective axes 10a and 12a on respective shafts 10b and 12b.

[0018] The continuous strip 4 is taken up by the suction roller 10 and advanced toward a cutting station 11 at which the first and second rollers 10 and 12 operate in conjunction in such a way as to divide up the strip into single papers 3. In the example illustrated, the diameter of the first roller 10 is larger than that of the second roller 12, and its peripheral velocity higher than the feed rate of the strip 4, whilst the peripheral surface carries a plurality of blades 13 spaced apart at identical angular distances, of which the respective cutting edges are substantially rectilinear and disposed skew in relation to the axis 10a of rotation. The second roller 12, which rotates at a peripheral velocity substantially equal to the feed rate of the strip 4, carries a plurality of substantially radial blades 14 distributed uniformly around the peripheral surface and disposed with their cutting edges substantially parallel to the axis 12a of the roller 12. The peripheral surface 15 of the first roller 10 is divided by the relative blades 13 into a plurality of aspirating sectors 16 each affording a plurality of suction holes 16a connected to a source of negative pressure (not illustrated, being conventional in embodiment).

[0019] The unit 2 further comprises feed means 17 serving to supply the continuous strip 4 to the cutter device 5, and operating in conjunction with the first roller 10 in such a way as to advance the strip 4 along the feed path P.

[0020] Observing figs 1 to 4, such feed means 17 will be seen to comprise a pair of pinch rolls 18 and 19 disposed on either side of the feed path P followed by the strip 4.

[0021] A gumming device 20 lying beyond the pinch rolls 18 and 19 in the feed direction is designed to coat the top face of the strip 4 thinly with an adhesive substance. The device 20 in question comprises a gumming roller 21 and a reaction roller 22 offered respectively to the opposite faces of the strip 4. Also forming part of the unit 2 are means 23 by which to vary the tension of the running strip 4, located between the gumming device 20 and the first roller 10; such tensioning means comprise a moving diverter element 24 which by alternately distancing and returning the strip 4 away from and back onto the feed path P produces a variation in the tension of the strip 4 between a taut condition denoted Tn1 and a relaxed condition denoted Tn2.

[0022] As discernible from fig 1, the diverter element 24 comprises a cam 25 engaging the strip 4 in direct contact and mounted to a pivot 26 centred on an axis of rotation denoted A.

[0023] The profile 27 of the cam 25 presents two lobes 28 and 29 constituting a first transmission member 30 and a second transmission member 31, respectively, by which the strip 4 is diverted.

[0024] The cam 25 is invested cyclically with alternating rotary motion about the aforementioned axis A between a first angular limit position PA1 and a second angular limit position PA2.

[0025] The alternating rotary motion in question will be transmitted to the cam 25 synchronously with the movement of the cutter device 5 by drive means of conventional embodiment denoted schematically in the drawings by a block 32.

[0026] The tension of the strip 4 is the same in either one of the aforementioned limit positions PA1 and PA2, and it is in this taut condition Tn1 that the first part of the cut is made in the strip 4 by the relative device 5.

[0027] For the second part of the cut to be made properly, as intimated in the preamble, the strip 4 needs to be at a tension Tn2 less than Tn1. To obtain this relaxed condition Tn2 of the strip 4, the cam 25 is rotated to a position denoted PA0, indicated by a bold line in fig 1, in which there is substantially no diversion of the strip 4 from the feed path P as it advances relaxed between

the gumming device 20 and the cutter device 5.

[0028] Following a complete cycle, starting for example from the limit position denoted PA1, the strip 4 is diverted from its normal trajectory by the cam 25, displaced from the feed path P by contact with the first transmission member 30 which coincides with the first lobe 28 of the selfsame cam 25. In this position PA1, as mentioned previously, the first part of a cut is made to separate a first paper 3. Thereafter the cam 25 rotates anticlockwise, as viewed in fig 1, to assume the position denoted PA0 in which the strip 4 rides over a portion 27a of the cam profile 27 interconnecting the two lobes 28 and 29. With the cam 25 in this position PA0, the strip 4 is brought to the relaxed condition Tn2 and, once the cut has been completed to separate the first paper 3, the cam 25 rotates further in the anticlockwise direction to assume the position denoted PA2 in which the strip 4 reassumes the taut condition Tn1 and the cutter device 5 begins the stroke that will separate a second paper 3. At this point, the direction of rotation of the cam 25 will be reversed through the agency of the alternating drive means 32, with the result that the cam 25 rotates clockwise back to the passive position PA0 in which the strip 4 is returned to the relaxed condition Tn2 and the cut is completed to separate the second paper 3. The cam 25 is rotated further by the drive means 32, ultimately regaining the initial position PA1, and the cycle thus completed. Clearly enough, each full oscillating cycle of the cam 25 is completed at a frequency equivalent to half the frequency at which the tipping papers 3 are separated by the cutter device 5. In short, two papers 3 are cut from the strip during each cycle of the cam 25.

[0029] In the example of fig 2, strip tensioning means 23 comprise a diverter element 24 that consists in a rocker 33 supported by a pivot 40 and rotatable about an axis denoted B.

[0030] The rocker 33 presents a first arm 33a and a second arm 33b engaging the strip 4 by way of respective contact rollers 35a and 35b. Each roller 35a and 35b is carried by a relative projecting end of the respective arm 33a and 33b, and freely rotatable. Similarly to the two lobes 28 and 29 of the cam 25, the two rollers 35a and 35b constitute respective first and second transmission members 30 and 31. The oscillating action of the rocker 33 is similar in every respect to that of the cam 25, in that it derives from power transmitted by the alternating drive means 32 in such a way as to produce rotary motion about the aforementioned axis B between two limit positions PA1 and PA2 in which the strip 4 is drawn taut.

[0031] The rocker 33 moves through a cycle like that of the cam 25, starting for example from the position denoted PA1 in which the strip 4 is in the taut condition Tn1, by rotating anticlockwise through the position denoted PA0 to that denoted PA2, in which the strip 4 assumes the relaxed condition Tn2 and reassumes the taut condition Tn1, respectively. On reaching the latter position PA2 ,the direction of the rotary motion is inverted and the rocker 33 will rotate clockwise back through the intermediate position PA0 to the initial position PA1, in which the strip reassumes the relaxed condition Tn2 and the taut condition Tn1, respectively.

[0032] The return to the initial position PA1 marks the end of the cycle.

[0033] In the example of fig 3, the diverter element 24 of the tensioning means 23 is embodied as a crank 36, pivotable about an axis denoted C, of which a free end is forked and exhibits two arms 36a and 36b.

[0034] The ends of the arms 36a and 36b carry respective rollers 47a and 47b offered in direct contact one to each face of the strip 4.

[0035] With this type of diverter element 24 the action is desmodromic, inasmuch as the strip 4 will not only be pushed away from its normal trajectory by the rollers 47a and 47b in such a way as to assume the taut condition on either side of the feed path P in alternation, but also pulled back into the relaxed condition by the selfsame rollers 47a and 47b. In this instance the gumming device 20 is placed to best advantage following the diverter element 24 along the feed direction, so that the effectiveness of the gumming operation will not be jeopardized by contact occurring subsequently between the strip 4 and the corresponding roller 47b.

[0036] Fig 4 illustrates a second embodiment of the cam 25 in which the portion 27a of the profile 27 between the two lobes 28 and 29 is of concave geometry. Such a solution might be adopted in order to limit the angular excursion of the diverter element 24 during the oscillating movement and thus minimize problems connected with the inertia of component parts in the element 24.

[0037] In effect, the width of the strip dictates the need for a diverter element of appreciable dimensions, of which the mass, given the high operating speeds of the machines in question, will generate inertia forces that can be attenuated at least by limiting the angular travel of the diverter element 24. Whichever of the embodiments described above may ultimately be adopted, the diverter element 24 is designed as a double acting component characterized by alternating rotary motion, and therefore capable of stroking at half the operating frequency of the cutter device 5.

[0038] As already stated, the complete oscillating cycle includes two steps or positions whereby the strip 4 is drawn taut, alternated with two steps in which the strip 4 is relaxed and advances in contact with portions of the cam 25 exhibiting a shorter radial dimension.

[0039] Still with the end in view of limiting the angular motion of the diverter element, a further solution is illustrated in figs 5 to 9. These figures show the operating sequence of one half the oscillating cycle of a diverter element 24 comprising a cam 37 pivotable about an axis of rotation denoted D. The profile 38 of the cam 37 exhibits three lobes 38a, 38b and 38c constituting respective transmission members 39a, 39b and 39c and disposed internally tangential to a common circumference of which the centre coincides with the axis D.

[0040] As in the embodiments already described, the cam 37 in question is set in motion by alternating drive means not shown in figs 5 to 9, which illustrate only the cam 37 and the diverted strip 4, in the interests of clarity.

[0041] Taking the start of the oscillating cycle for this particular cam 37 to be the position denoted PB0 in fig 5, in which the strip 4 is lifted by a first lobe 38a from the feed path P and caused to assume the taut condition Tn1, the sequence is essentially the same as already described for the embodiments of figs 1 to 4, in that the taut condition Tn1 and the relaxed condition Tn2 of the strip 4 correspond respectively to the first and second stages of the stroke with which the tipping paper 3 is separated by the cutter device 5.

[0042] Thereafter, the cam 37 rotates anticlockwise in the direction of the arrow (see fig 5) to assume the position denoted PB1 illustrated in fig 6, in which the strip 4 follows a linear trajectory along the feed path P advancing in the relaxed condition Tn2. Rotating further anticlockwise, the cam 37 takes up the position PB2 illustrated in fig 7, in which the strip 4 is tensioned in the taut condition Tn1 by the action of a second lobe 38b.

[0043] Fig 8 illustrates a subsequent position PB3 of the cam 37 in which the strip 4 is once again in the relaxed condition Tn2 and rides over two lobes 38b and 38c positioned tangentially to the feed path P. The cam 37 makes one more anticlockwise rotation toward a limit position PB4 illustrated in fig 9, in which the strip 4 is again tensioned in the taut condition Tn1 through the agency of the remaining lobe 38c. At this point the direction of rotation is inverted and the sequence repeated in reverse order, with the cam 37 moving in the direction of the arrow in fig 9 through the positions PB3, PB2 and PB1 described above to regain the starting position PB0. On arrival at this same position PB0, the oscillating cycle of the cam 37 is completed. It will be evident from the foregoing description that when using a diverter element 24 with three transmission members 39a, 39b and 39c the frequency of the oscillations described by the element 24 is equivalent to a third of the frequency with which the tipping papers 3 are separated from the strip by the cutter device 5.

[0044] It follows that the number of transmission members incorporated into the diverter element 24 can be increased to "n", and the oscillating frequency of the diverter element consequently made equivalent to 1/n times the operating frequency of the cutter device 5.

[0045] Accordingly, and by adopting any one of the various embodiments described and illustrated, it becomes possible to obtain operating speeds higher than those obtainable hitherto without jeopardizing the smooth operation of the filter tip attachment and moreover reducing the mechanical stress to which the components of the diverter element 24 are subjected at a given operating tempo.

Claims

1. A unit for generating discrete lengths of paper material from a continuous strip, comprising cutting means (5) by which the papers (3) are severed singly and in succession from the strip (4) at a predetermined cutting frequency, also feed means (17) by which the strip (4) is caused to advance along a predetermined path (P) and in a predetermined direction (D) at a first predetermined tension (Tn1), and tensioning means (23) interposed between the feed means (17) and the cutting means (5) of which the function is to vary the first predetermined tension of the strip (4) cyclically and synchronously with the selfsame cutting means (5), characterized in that the tensioning means (23) comprise a diverter element (24) presenting at least a first and a second transmission member (30, 31) and designed to oscillate cyclically when in operation between two tensioning limit positions (PA1, PA2) in which the at least first and second transmission members (30, 31) interact alternately with the strip (4) in such a way that the strip is diverted and caused to assume the first tension (Tn1), passing also through an intermediate position (PA0) in which the strip (4) is caused to assume a second tension (Tn2) slacker than the first, and completing each full oscillating cycle between the two limit positions (PA1, PA2) at a frequency equivalent at least to half the cutting frequency of the cutting means (5).

2. A unit as in claim 1, wherein the diverter element (24) comprises a cam (25) of which the profile (27) presents two distinct lobes (28, 29) coinciding respectively with the first and second transmission members (30, 31), and of which the action consists in alternating rotary motion brought about between the two limit positions (PA1, PA2) in which the strip (4) assumes the first tension.

3. A unit as in claim 2, wherein the profile (27) of the cam (25) includes a portion (27a) of concave geometry interconnecting the two lobes (28, 29).

4. A unit as in claim 1, wherein the diverter element (24) comprises a cam (37) of which the profile (38) presents three distinct lobes (38a, 38b, 38c) coinciding respectively with first, second and third transmission members (39a, 39b, 39c), and of which the action consists in alternating rotary motion compassing three positions (PB0, PB2, PB4) in which the strip (4) assumes the first tension and two intermediate positions (PB1, PB3) in which the strip (4) assumes a second tension slacker than the first, brought about in such a way that each full cycle of oscillation between the two limit positions (PB0, PB4) is completed at a frequency equivalent to one third the operating frequency of the cutting means

(5).

5. A unit as in claim 1, wherein the diverter element (24) comprises a rocker (33) pivotable about the axis (B) of a relative fulcrum, embodied with equidistant first and second extremities (34a, 34b) offered in contact to the strip (4) and invested with alternating rotary motion about the selfsame axis (B) between the two limit positions (PA1, PA2) in which the strip (4) assumes the first tension.

6. A unit as in claim 5, wherein each of the first and second extremities (34a, 34b) of the rocker (33) carries a respective roller (35a, 35b) engaging in contact with the strip (4).

7. A unit as in claim 1, wherein the diverter element (24) comprises a crank (36) pivotable about the axis (C) of a relative fulcrum, of which at least the free end is forked and exhibits two arms (36a, 36b) carrying respective rollers (47a, 47b) offered in direct contact one to each of the opposite faces of the strip (4).

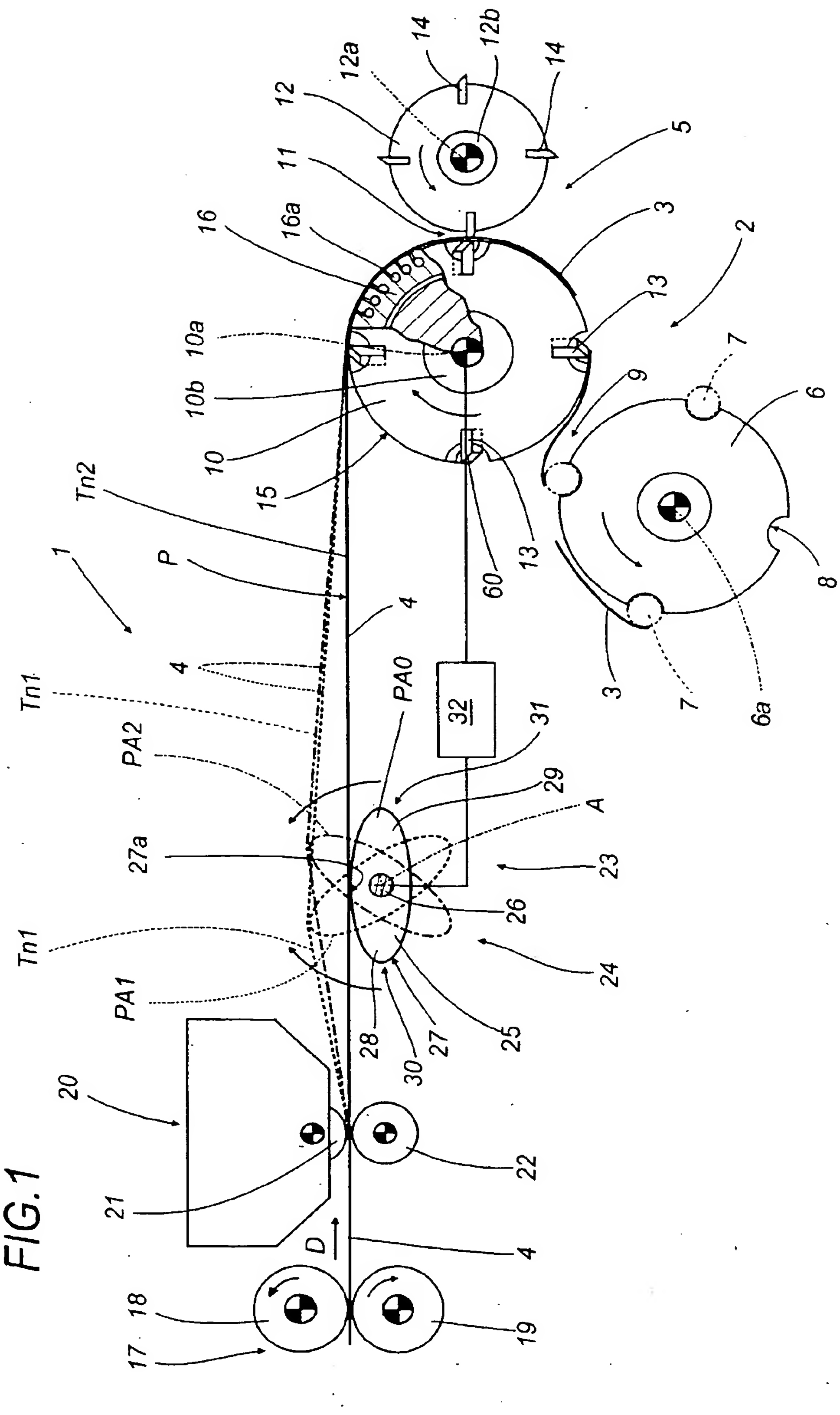
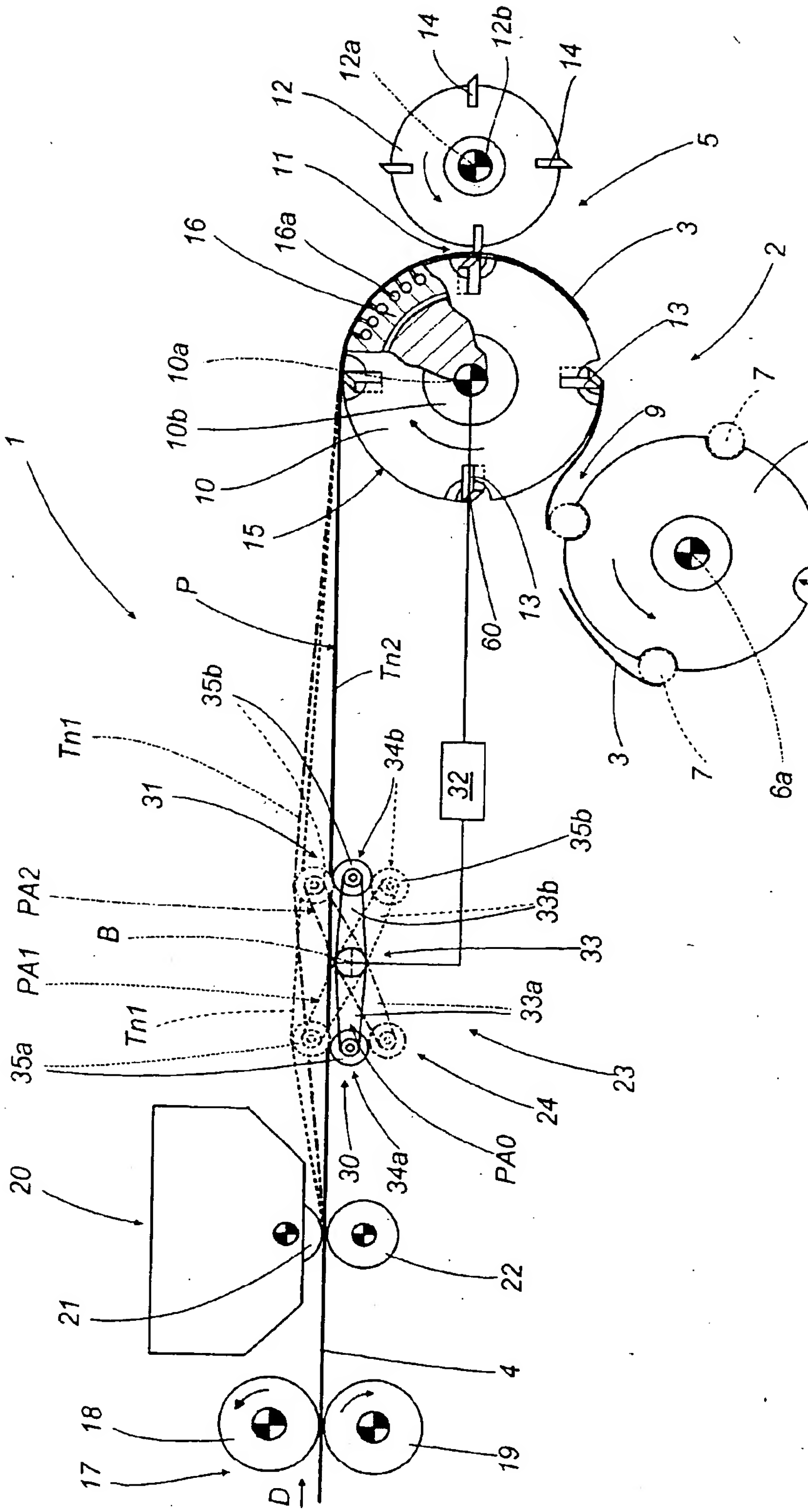


FIG.1

FIG.2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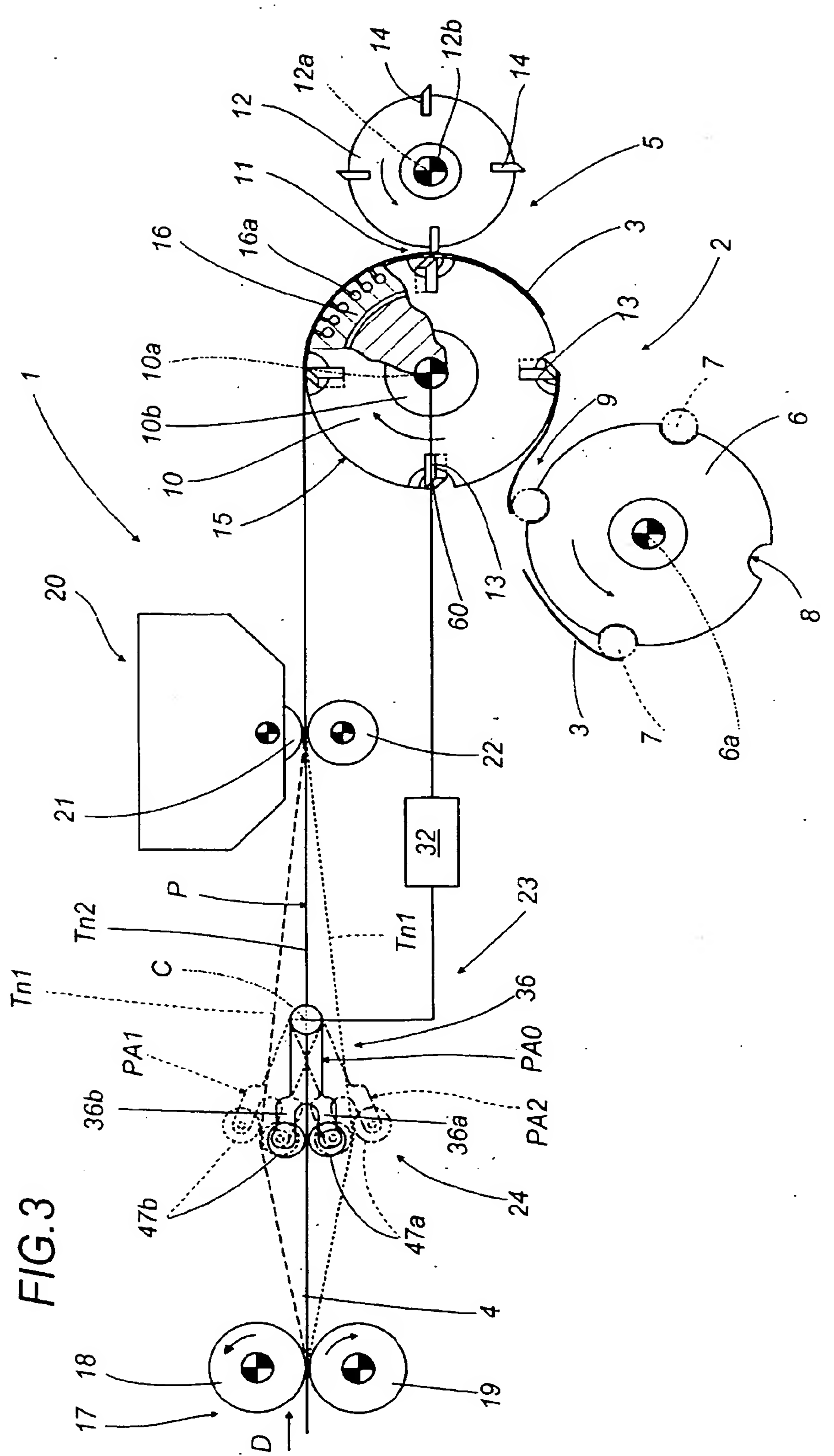
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36
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PA0
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Tn2

FIG.3

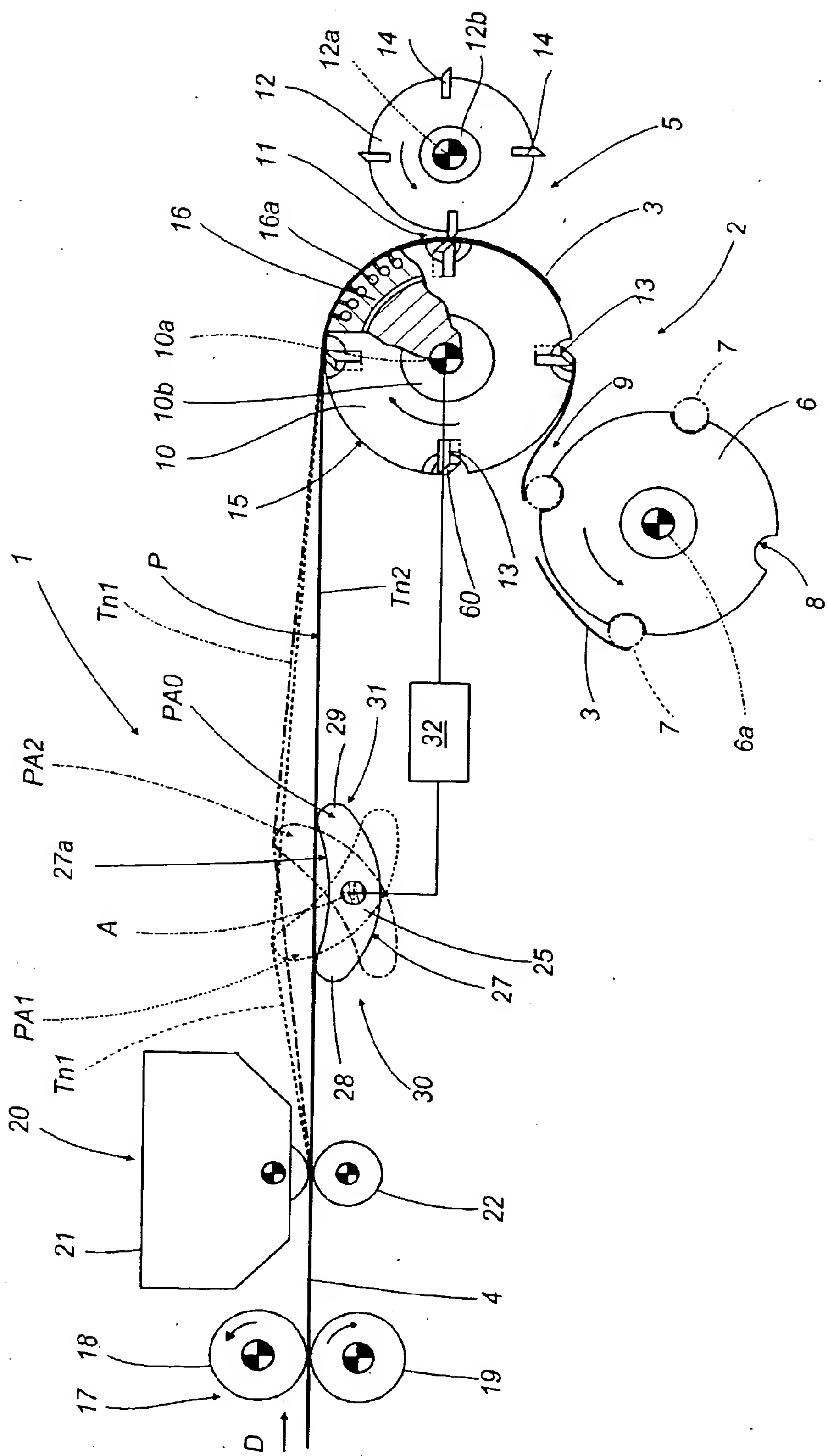
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FIG.4

FIG.5

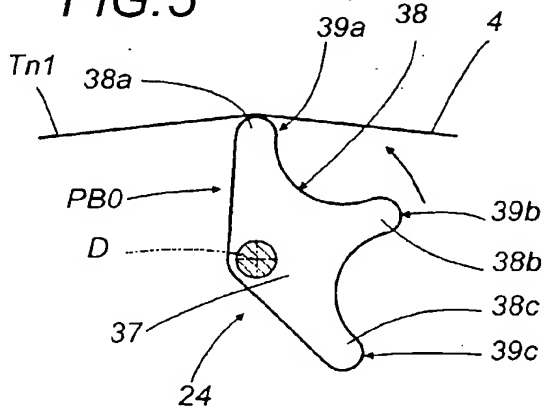


FIG.6

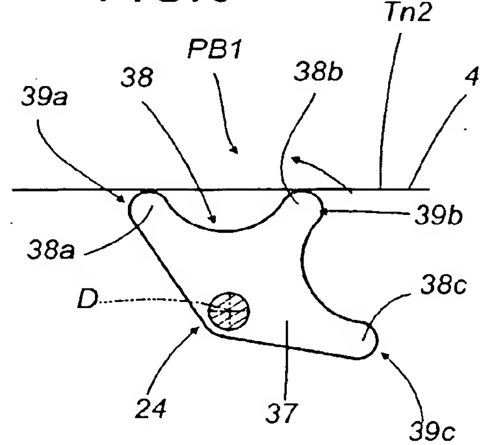


FIG.7

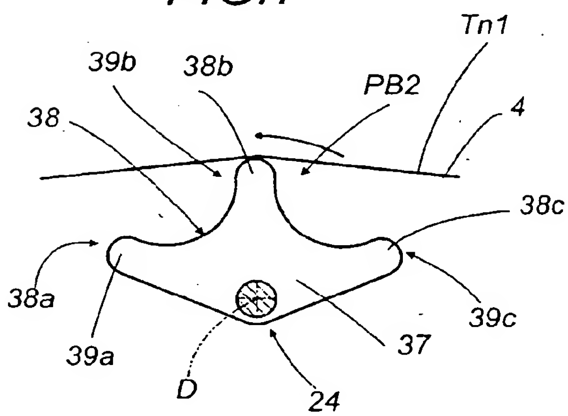


FIG.8

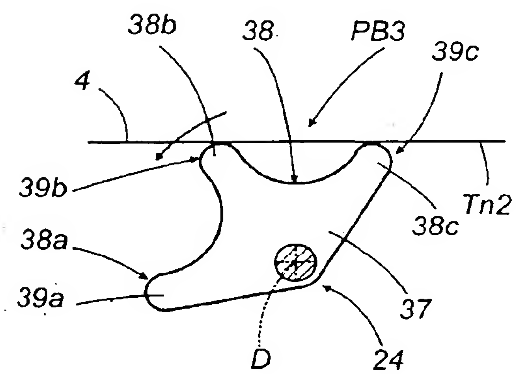
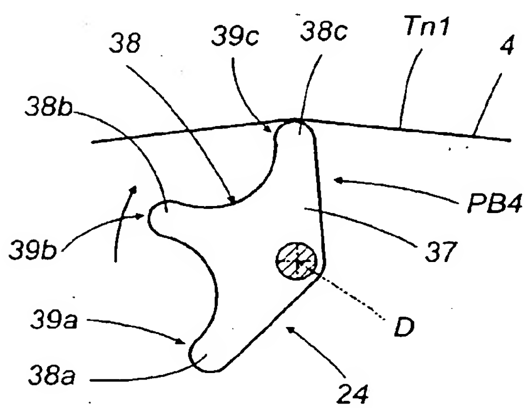


FIG.9



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EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0695

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 054 346 A (HEITMANN) 8 October 1991 (1991-10-08) * column 11, line 13 - column 12, line 38; figures 2-4 *	1	B65H35/08 B65H23/04
D,A	US 4 943 341 A (MATTEI) 24 July 1990 (1990-07-24) * column 8, line 11 - line 46; figure 17 *	1	
A	US 2 957 450 A (PHILLIPS) 25 October 1960 (1960-10-25) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
B65H
A24C
B26D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 February 2001	Raven, P

CATEGORY OF CITED DOCUMENTS

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